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Toward a Theology of Divine Action: William R. Stoeger, S.J., on the Laws of Nature

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Abstract
In the 1990s William Stoeger, S.J., contributed major essays on the laws of nature to the series of conferences on divine action that were cosponsored by the Vatican Observatory and the Center for Theology and the Natural Sciences at the Graduate Theological Union Berkeley, CA. He argued that the laws of nature are to be seen as approximate models rather than as complete descriptions of nature, and that they are descriptive rather than prescriptive. These essays, Denis Edwards proposes, are an important legacy for 21st-century theology and offer creative possibilities for a renewed theology of divine action that builds on the Thomist tradition.

Keywords
Aquinas, creation, divine action, laws of nature, mind–brain, miracles, nonintervention, primary causality, secondary causality, quantum mechanics

William Stoeger, a Jesuit of the California province, was a staff scientist of the Vatican Observatory Research Group in Tucson until his death on March 24, 2014. He specialized in theoretical cosmology, high-energy astrophysics, and in the interrelationship between science, philosophy, and theology. He earned his PhD in astrophysics from the University of Cambridge, where he was a classmate of Stephen Hawking and studied under Astronomer Royal Sir Martin Rees. Guy Consolmagno, another US Jesuit on the Vatican Observatory staff, points out that Stoeger's scientific output was prolific and highly regarded—including the publication of two major papers on cosmology or general relativity each year, most recently on the

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interconnection between theoretical cosmology and the observed structure of the universe, as seen in distant galaxies.[1]

There is another side to Stoeger's academic work—his contributions to the dialogue between theology and science. One aspect of this was his long-standing and faithful commitment to the "Theology and Science" topic sessions of the conventions of the Catholic Theological Society of America. Another aspect, the focus of this article, was his role in a series of research conferences on divine action that gathered scientists, philosophers, and theologians from around the world. These conferences began when Pope John Paul II asked the Vatican Observatory to further the science–theology dialogue by organizing a conference to celebrate the 300th anniversary of Isaac Newton's *Principia*,[2] at which key participants began to consider the possibility of a series of such conferences. To test the feasibility of this idea, Stoeger, of the Vatican Observatory, and Robert John Russell, of the Center for Theology and the Natural Sciences at Berkeley (CTNS), organized an initial conference at Castel Gandolfo outside Rome in September 1987. The publication that resulted from this conference, with an opening message from Pope John Paul II, is a wonderfully rich resource in the dialogue between science and theology from the late 20th century.[3]

The success of this conference led George Coyne, S.J., director of the Vatican Observatory, to propose that a series of five such conferences be held over a decade. A long-term steering committee was set up made up of Stoeger, Russell, and Nancey Murphy from Fuller Theological Seminary. Coyne invited CTNS to cosponsor the series of research conferences with the Vatican Observatory.[4] It was agreed that the organizing theological theme would be the nature of divine action, and that this theme would be taken up in the light of advances in five particular scientific areas: quantum cosmology, chaos and complexity, evolutionary and molecular biology, neuroscience, and quantum mechanics. The focus would be not simply on God's continuous creative act, but on the Christian conviction of God's particular acts in the history of salvation and in human lives ("special divine action").

Stoeger's contribution involved not only planning, organization, and coediting of volumes that emerged from the colloquia, but also his own substantial essays in each volume. In one of these he develops his own approach to a noninterventionist theology of divine action in relation to Aquinas's theology of primary and secondary causality.[5] Apart from

1. Guy Consolmagno, "Across the Universe: Big Bang Bill," *Tablet* 268 (April 26, 2014) 36.
2. See George V. Coyne, Mochał Heller, and J. Życiński, eds., *Newton and the New Direction in Science: Proceedings of the Cracow Conference* (Vatican City: Vatican Observatory, 1988).
3. Robert John Russell, William R. Stoeger, S.J., and George V. Coyne, S.J., eds., *Physics, Philosophy and Theology: A Common Quest for Understanding* (Vatican City: Vatican Observatory, 1988).
4. For an account of these developments see Robert John Russell, "Introduction," in *Quantum Cosmology and the Laws of Nature: Scientific Perspectives on Divine Action*, ed. Robert John Russell, Nancey Murphy, and C. J. Isham (Vatican City: Vatican Observatory; Berkeley, CA: Center for Theology and the Natural Sciences [CTNS], 1993) 1–32.
5. William R. Stoeger, "Describing God's Action in the World in Light of Scientific Knowledge of Reality," in *Chaos and Complexity: Scientific Perspectives on Divine*

Stephen Happel, Stoeger was something of a lone voice in embracing a Thomist account.[6] A substantial group of scholars (including Russell, Murphy, George Ellis, and Thomas Tracy) explored the idea that God acts in the indeterminacy of quantum events to bring about particular outcomes in the macro world. Others, such as Ian Barbour, contributed insights from Whiteheadian process theology. John Polkinghorne saw God as acting through the openness of nature, by the top-down imparting of information. Arthur Peacocke saw God as acting in and through every aspect of nature, acting on the system as a whole, by analogy with a whole-part or top-down cause.

Stoeger's contributions to the various conferences and volumes, I propose, do far more than articulate a standard Thomist account of divine action. They provide a highly fruitful development of the Thomist position and offer a basis for further theological developments. My intention in engaging with his works here is to show, first, that three of his five contributions can be read as organically developing a fundamental argument: that the laws of nature as we know them through the sciences are constructed models of what occurs in nature; that the laws are not isomorphic with the natural world; and that the complex and rich reality of the world around us far exceeds our capacity to model it in our scientific theories and laws. This line of thought, then, suggests the possibility that God may be acting not only through the laws we know but also in the natural world that is far beyond our current laws.

Stoeger's three contributions represent a detailed engagement with the various sciences and complex philosophical explorations. Each of the articles works in a particular scientific context, shaped by the theme of the conference in which it was offered. Each sheds light on the other two and enables a better interpretation of them. I hope to show that a reading of these three essays as an interconnected argument offers creative possibilities for a renewed theology of divine action that builds on the Thomist tradition.[7] My reading of Stoeger's work does not attempt to represent the detail and complexity of the original articles, nor is it simply a summary; rather, it is an attempt to demonstrate the power and scope of the sustained argument at work in the series.

My second intention here is to propose that Stoeger's argument constitutes an important breakthrough in the theology of divine action, one that, though largely unrecognized in the literature, is highly significant not only for the science–theology field but also for broader Catholic theology. If Stoeger's claim is correct, then many aspects of theology would be impacted. If his insights, so deeply based in the sciences, were to find acceptance in the Catholic theology of creation, incarnation, providence,

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Action, ed. Robert John Russell, Nancey Murphy, and Arthur R. Peacocke (Vatican City: Vatican Observatory; Berkeley, CA: CTNS, 1995) 239–61.

6. Stephen Happel, "Divine Providence and Instrumentality: Metaphors for Time in Self-Organizing Systems and Divine Action," in *Chaos and Complexity* 177–203.
7. Stoeger's fifth paper, not directly related to the three on the laws of nature, is "The Immanent Directionality of the Evolutionary Process, and Its Relationship to Teleology," in *Evolutionary and Molecular Biology: Scientific Perspectives on Divine Action*, ed. Robert John Russell, William R. Stoeger, and Francisco J. Ayala (Vatican City: Vatican Observatory; Berkeley, CA: CTNS, 1998) 239–61.

and miracles, for example, then new possibilities might well open up for dialogue with contemporary culture and for evangelization in today's world. The claim I am making, then, is that Stoeger's argument constitutes an important legacy to 21st-century theology, one that calls for wide discussion and debate in Catholic theology.

In my last section, I attempt to show the consequences of this legacy by taking up just one example, the theology of miracles. In what follows, then, I offer a reading of Stoeger's three papers in turn, focusing on the first where he lays out his general position, and then more briefly on his essays on neuroscience and quantum mechanics. In the final section I will point to the importance of these insights for a contemporary theology of divine action by focusing on miracles as one important aspect of God's action in the world.

The Ontological Status of the Laws of Nature

In the first of his three essays,[8] Stoeger explores what he sees as the fundamental question underlying all discussion between science and theology: How should we think about the laws of nature? His answer involves an extended argument for three interrelated positions. First, the laws of nature are to be seen as approximate models and idealized constructions of nature, which are never complete and never isomorphic descriptions of the far more complex world to which they refer. Second, the laws are descriptive rather than prescriptive; although they describe fundamental regularities in nature, they are not the source of the regularities they describe, nor the source of their physical necessity. Third, the laws do not exist independently of the reality they describe, thus ruling out a preexisting or "Platonic" interpretation of the laws of nature.

Stoeger argues for these positions in two steps, beginning with the experience of the natural sciences and then moving to a more philosophical articulation of his position. He begins his argument by reflecting on highly successful scientific theories in physics. Even with such theories, he points out, we have the almost continual experience of "replacing or subsuming laws and well-confirmed theories by more comprehensive ones, which more adequately describe the relevant aspects of phenomena under a wide range of conditions."[9] A prime example is Newton's theory of gravitation, which has now been subsumed as a limited case of Einstein's general relativity. Newton's theory is still regarded as valid, and as giving correct predictions for relatively weak gravitational fields such as obtain on Earth, and for velocities that are much below the speed of light. But the new theory, general relativity, gives a completely revised description of the underlying reality. The movement between the two theories represents a radical paradigm shift, which is adopted only on the basis of controlled experiments and careful observations. The new theory and laws describe a larger range of conditions than the older ones, and predict further phenomena that can be tested. Still, the new theory may itself be replaced by another. In the case of gravity, it is possible that general

8. William R. Stoeger, "Contemporary Physics and the Ontological Status of the Laws of Nature," in *Quantum Cosmology and the Laws of Nature* 209–34.
9. Stoeger, "Contemporary Physics" 212.

relativity will be replaced by a quantum theory of gravity—the topic of both the conference and the volume in which Stoeger's essay appears.

The recognition of such paradigm shifts should lead us to question the common practice of speaking of "laws of nature" as if they were complete and immutable explanations of the regularities and the interrelationships that are found in physical reality. By contrast, Stoeger insists that the experience of major paradigm shifts in science, as in the instance of gravity, leads to the conclusion that the laws and theories involved are actually models, or "approximate descriptions," even if they are detailed and accurate descriptions.[10]

With the case of gravity we have at least two theories and two sets of laws that work equally well in certain circumstances. Which one better represents physical reality as it is in itself? The answer to this question, Stoeger argues, depends on our criteria for what is judged as better, for what constitutes a good representation, and for what we think reality is in itself. Since we do not have access to physical reality independently from the phenomena we can observe, our observations of them are necessarily "theory laden" in the way we design experiments, make observations, and interpret results. Such reflections, he suggests, warn against the illusions to which we are subject when we talk about our scientific theories and laws of nature: we can easily talk as if they were complete descriptions of nature itself.

Stoeger points out that there are often free parameters or constants in our theories or laws that are not determined by laws themselves. These and other factors he discusses lead him to conclude that our best theories and laws have an incomplete, approximate, and descriptive character. They represent reality but do so only partially: "They reveal but they also hide aspects of physical reality."[11] He points to theoretical entities and concepts like temperature, entropy, electrons, photons, and attributes of particles such as mass, spin, and charge. What is the relationship between these abstract theoretical entities and the phenomena they describe and to some extent explain? Stoeger responds:

> It is really that of a model to the very rich and full patterns of kinematic, dynamic and structural behavior we observe. The model represents in an idealized and imperfect way the structures we find manifested in the phenomena and the detailed qualitative and quantitative relationships which appear to exist among them. However, it leaves a great deal out too—and sometimes it leaves out sophistications and precisions we desperately wish to include, but do not know how. It is an illusion to believe that these incredibly rich representations of the phenomena are unconstructed isomorphisms we merely *discover* in the world. Instead they are *constructed*—painstakingly so—and there is no evidence that they are isomorphic with structures in the real world as it is in itself.[12]

The reason we are successful with such theories and their mathematical models is that there are levels of reality in which the dominant behavior is relatively simple and

10. Ibid.
11. Ibid. 215.
12. Ibid. 216.

uncomplicated, as, for example, in the movement of planets around the sun. But there are other situations, such as the dynamic behavior of biological systems, that are too complicated for such straightforward modeling, where it is impossible or extremely difficult to isolate the laws from the highly complex states of the systems and the boundary conditions. Stoeger points out that in biology, whether in the functional or evolutionary disciplines, laws are rarely spoken of as they are in physics, and then only in analogous ways. Because of the complexity of biological systems, universality, explanatory power, simplicity, and predictability are all far more problematic in biology than they are in physics.[13]

Stoeger moves from a phenomenological reflection on the experience of the sciences to a more philosophical analysis and formulation. I will summarize his comments on the three questions identified at the beginning of this section.

Question 1: To what extent do successful and well-confirmed physical theories and the laws they embody describe reality in itself? Stoeger makes it clear that such theories do have a very strong basis in observed reality, but that they do not describe physical reality as it is in itself. They do not reveal all the features of the reality under observation, not even its most fundamental features. Many of these remain hidden from us because: (1) our science tends to focus on stable and characteristic features; (2) that are observed at energies we are able to detect; (3) that we can isolate, simplify, and model in concepts such as mass, velocity, and energy; (4) that are relevant to our interests in performing experiments and constructing theories; and (5) that are framed by our heuristic anticipations in designing and interpreting experiments.

While some parts of reality can be successfully modeled—they are "algorithmically compressible"[14]—other important areas are not. This is true, for example, even of complex physical systems found throughout the natural world in such everyday realities as fluids exhibiting strong turbulence. In these systems, "order and chaos nourish one another with a strange reciprocity."[15] It becomes extremely difficult to model or algorithmically compress the observed reality. Stoeger writes: "As we move into the science of complex chemical molecules, into biology, neurophysiology, psychology, economics, politics, and sociology, these problems increase and prevent us from describing phenomena in anything like the lawlike and rigidly predictable way to which we are accustomed in physics and mathematics."[16] For Stoeger, then, our laws of nature and the theories that enshrine them are carefully constructed models, incomplete and imperfect descriptions of what we observe in the far more complex world around us.

Question 2: Given that many of our physical theories and their laws are successful and well confirmed by the evidence, do such laws of nature *prescribe* the behavior we

13. Stoeger refers here to Ernst Mayr, "Is Biology an Autonomous Science?," in *Toward a New Philosophy of Biology*, ed. Ernst Mayr (Cambridge, MA: Harvard University, 1988) 8–23.
14. A physical system is said to be algorithmically compressible when it can be modeled mathematically.
15. Stoeger, "Contemporary Physics" 224.
16. Ibid.

observe in nature? They can certainly give the impression of doing so, because they are painstakingly accurate descriptions of a hierarchy of interrelated phenomena isolatable and characterized by highly regular behavior that can be generalized in lawlike terms. But, Stoeger argues, this impression is an illusion. There is no justification for claiming that the laws are the source of behavior we see in nature, or that they exercise constraints on the behavior. He points out that one of the reasons why laws of nature came to be seen as prescriptive is that they were originally thought of as God's laws. While this metaphor may have some application to the regularities of the natural world seen as God's creation, Stoeger insists it should not be applied literally to constructed laws of nature. Such laws are descriptive rather than prescriptive:

> In a way, saying that something is a "law of nature" is simply a way of indicating that it is so fundamental to the description of the detailed workings of physical, chemical or biological systems that it never is observed not to hold when those systems are properly isolated and simplified and certain conditions are fulfilled. But there seems to be little support for the position that the law is the cause of the regularity observed or that it forces physical, chemical or biological entities to behave in the way they do.[17]

A law is simply a description of the regularity and its fundamental character. What enforces this regularity is not the description. Sometimes an intermediate cause of lawlike behavior is revealed in another level of physical process that is a consequence of relationships at a more fundamental level. An example is the way laws of chemical reactions are now seen as grounded in the deeper level of atomic structure. But, Stoeger insists, these deeper connections do not explain in any complete way why reality is the way it is. The models we make can give the impression of imparting necessity, "but the apparent necessity does not come from the models; it is hidden in the observed realities and in the entities which adhere to them. Its ultimate source is not accessible to our probing."[18]

Question 3: To what extent can the laws of nature be endowed in a justified way with an existence independent of the objects they govern?[19] Based on his answers to the previous two questions, Stoeger sees it as difficult to justify the claim that the laws have an independent existence. In fact he thinks the claim does not make sense, since the laws belong to the models and to the entities that constitute them. The question rests on the confusion between our laws and the regularities and relationship of nature itself. It also rests on the unwarranted philosophical assumption that the regularities of nature are based on something preexistent, like a blueprint for a building. Hence

17. Ibid. 225.
18. Ibid.
19. Stoeger discusses two further questions: on the possibility of postulating other sets of laws in an alternative set of entities or ensembles of other universes, and on finding a single overarching fundamental law of the universe. I leave them aside here in order to follow his key ideas through the three essays and to situate them in relation to the theology of divine action.

Stoeger rejects a Platonic view of the laws of nature on the basis that it has no scientific or philosophical justification.

Stoeger then argues for a general epistemological position that can be called an "empirical realism," because he sees the theories, laws, and models of science as having a firm basis in reality. Such scientific knowledge is knowledge that is widely shared, tested in experiment and against the predictions it makes, and continually reassessed. But he also claims that his own epistemological position is "weakly objective," because it is a brand of realism that does not claim to know physical reality as it is itself.[20] With this assessment, Stoeger endorses Bernard D'Espagnat's view of the limits of our knowledge in the light of quantum mechanics,[21] and he builds on the insights of Bas van Fraassen, particularly in the rejection of the idea that the laws of nature enforce a physical necessity.[22]

At the end of this first of his three essays, Stoeger points out that the conception of the laws of nature he has outlined offers a context for discussing God's action in the universe, a context quite different from that of a strongly realist view. Stoeger nevertheless insists that not only is it still appropriate to think of God working through the laws of nature, but that it is now also possible to think of God acting principally not through "our laws" but rather through "the underlying relationship and regularities in nature itself, of which 'our laws' are but imperfect and idealized models."[23] Through revelation we Christians see God as acting in the particular and the personal. And, in the light of the argument advanced here, the Creator can be thought of as acting continuously in and through the complex and rich interrelationships of the physical world that our laws only partially model and describe.

The Laws of Nature and the Mind–Brain Problem

Stoeger's second essay applies his thinking about the laws of nature to the problem of how we understand the relationship between the brain and mental states.[24] He does not seek to resolve this extremely complex problem, but to clear the ground by clarifying certain key concepts. I highlight two aspects of his work here: his clarification of the concepts of the physical and the mental or spiritual and his understanding of constitutive relationships.[25]

Stoeger begins with a reformulation of the crucial distinction he has established between two possible meanings of the laws of nature: "We may mean the regularities,

20. Stoeger, "Contemporary Physics" 230.
21. Bernard D'Espagnat, *Reality and the Physicist* (Cambridge, UK: Cambridge University, 1989).
22. Bas C. Van Fraassen, *Laws and Symmetry* (Oxford: Clarendon, 1989).
23. Stoeger, "Contemporary Physics" 234.
24. William R. Stoeger, "The Mind–Brain Problem, the Laws of Nature, and Constitutive Relationships," in *Neuroscience and the Person: Scientific Perspectives on Divine Action*, ed. Robert John Russell et al. (Vatican City: Vatican Observatory; Berkeley CA: CTNS, 1999) 129–46.
25. This means I will deal only in passing with other important concepts that Stoeger develops, particularly his work on reducibility, emergence, and supervenience.

relationships, processes, and structure in nature: (1) as we know, understand, and model them; or (2) as they actually function in reality, which is much, much more than we know, understand, or have adequately modelled."[26] He goes on to speak of "our laws of nature" to describe the first, and "the laws of nature" to describe the second. He proposes that this distinction is particularly helpful in dealing with the mind–brain problem.

Stoeger begins by considering the relationship between the physical and the non-physical aspects of reality, between matter and spirit, and particularly between the brain and the mind. He points out that "matter" is not a well-defined scientific concept, but that the concepts of "mass" and "energy" are. He asks about the characteristics of matter or, more specifically, of mass energy. He proposes that we need to include not only life but also mental capacity as potential properties of matter, even though we do not yet understand the laws of nature that enable matter to give rise to these characteristics. Of course, matter possesses these characteristics only when it is organized in specific ways. Mind, or spirit, exists only in relation to matter that is organized in a "highly neurological way."[27] Mind is not immaterial, in the sense of being separate from matter or independent of matter. It might possibly be called immaterial in common speech, but this is because it involves qualities of matter that go beyond what we can model or understand in our current science.

Central to the mind–brain question, Stoeger insists, is the fact that our scientific understanding of the issues is so limited. We certainly know that the mind is related to the brain and to physical processes and events, but we do not know how: "What we must admit is that we really do not understand the capacities of the physical and the mental when it is neurologically organized."[28] We know that matter in the form of the brain is necessary for our experiences of mind or spirit. But we have no adequate scientific account of the interrelationship between the brain and the mind. Our laws of nature as they currently exist do not adequately account for the relationship between the brain and the mind, or for the experience of oneself as self-conscious and free, or for interpersonal relationships, let alone for religious experiences.

Having insisted that our current science faces severe limits in talking about the mind–brain relationship, Stoeger then offers a fresh way of looking at the issue through "constitutive relationships."[29] This expression refers to the way realities from an atom to a cell, to a molecule, to an organ like the brain, and far beyond to the universe can be described in terms of nested hierarchical structures. The relationships between entities at one level constitute new entities at another level. Constitutive relationships involve all the relationships and interactions, both internal and environmental, that incorporate components at one level into a more complex whole at another level. These constitutive relationships are the foundation for the unity of an entity or organism and for its properties and behavior. These relationships can enable something new

26. Stoeger, "Mind–Brain Problem" 130.
27. Ibid. 134.
28. Ibid.
29. Ibid. 136–37.

to emerge, something more than a simple aggregation (such as a pile of logs). When the characteristics of an entity are essentially different from those of its components, when it cannot be reduced to its parts. Stoeger speaks of the new entity as mereologically irreducible.[30] It functions as a new, distinct whole, with properties not found in its components. When this occurs, Stoeger proposes that it be considered an emergent property.[31]

Another concept Stoeger uses at this point is supervenience, which, for him, refers to the dependence of higher-level states or properties on lower-level states or properties. The higher-level properties, however, are not generally reducible to the lower-level properties. In this way, "chemical properties are 'supervenient'—or 'supervene'—on physical properties, and mental states are 'supervenient' on brain states."[32] Higher-level entities that supervene on more fundamental entities are formed by their constitutive relationships, which organize the fundamental entities into more complex entities, whose characteristics and behaviors cannot be predicted by knowledge of the fundamental entities.

For Stoeger, then, mental states supervene on brain states, but mental states are not simply determined by brain states. While they depend on brain states, they are determined by all the constitutive relationships at the level of the mental states—their relationships with one another and with their environment. Stoeger points out that many researchers in philosophy of mind and neurophysiology have been preoccupied with a bottom-up approach, but, he insists, this cannot show us the full picture:

> The full picture—concerning these crucial constitutive relationships to which we have been appealing—must also essentially involve the "top down" orientation. This means that the character of the brain states themselves is strongly influenced by the mind and consciousness, as well as by the body and its components.[33]

He goes on to show how the human mind depends not only on the body but also on all the relationships of a human life, very much including the interpersonal relationships:

> For instance, if we take the example of the human brain, it is certainly obvious that some of its constitutive relationships specify how it is constructed from individual neurons into certain types of neuron bundles, which in turn are part of larger, highly differentiated neuron groups or brain areas such as the cerebral cortex, the amygdala, the hippocampus, etc. However, what also essentially specifies that it is a human brain is its relationship with the rest of the human body, not only at the present moment but also at previous moments in the body's history, including its conception from a particular egg and a particular sperm cell, its

30. Based on the Greek word for part, *meros*.
31. Mereological irreducibility is thus distinct from causal irreducibility. Causal irreducibility occurs when higher-level causes are not determined solely by causes operating at a more fundamental level, but by external causes or top-down causes. Something that is mereologically irreducible and therefore emergent may or may not be causally irreducible.
32. Stoeger, "Mind–Brain Problem" 142.
33. Ibid. 144.

> fetal development, and its infancy. This automatically involves the fact that this body is or was a living human person interacting with his or her environment, with other persons, and with society as a whole. Thus, the brain is the brain of a particular person, its capabilities—in terms of its brain states and the bodily, personal, and mental behavior they support—depend on an enormous variety of relationships.[34]

The mind involves not only dependency on a complex pattern of evolving brain states, but also all the relationships with the outside world that make up a person's life, including the social world. Leading neuroscientist Michael Gazzaniga says something similar:

> In the end, my argument is that all of life's experiences, personal and social, impact our emergent mental system. These experiences are powerful experiences modulating the mind. They not only constrain our brains but also reveal that it is the interaction of the two layers of brain and mind that provide our conscious reality, or moment in real time.[35]

To know and describe these relationships and their impact on brain states in detail does not seem possible at this stage, and may never be possible. Some of the constitutive relationships involved in the mind–brain problem are not accessible to science because of science's analytic and reductionist methods. Stoeger suggests that some constitutive relationships, including those involving states of consciousness, may not be accessible to science on principle.[36]

At the end of this essay, Stoeger returns to his fundamental question, "What are the laws of nature—what are the constitutive relationships—effecting such a unified, sophisticated, and dynamic kind of organization?"[37] In his view, our current laws of nature have revealed a very great deal about the brain, and make it clear that the mind is dependent on brain states, but do not take us far in dealing either with mind or with the personal. When we consider the mind, or consciousness, or the nature of a person, or interpersonal life, to say nothing of the relationship with God, our laws of nature are severely limited in what they can tell us about the far greater and more mysterious reality in which we participate.

The Laws of Nature in the Light of Quantum Theory

In his third essay, Stoeger turns to the counterintuitive world of quantum mechanics.[38] He asks: To what extent does quantum theory give us access to the underlying reality?

34. Ibid. 145.
35. Michael S. Gazzaniga, *Who's in Charge? Free Will and the Science of the Brain* (New York: HarperCollins, 2011, 2012) 218.
36. Stoeger, "Mind–Brain Problem" 146.
37. Ibid.
38. William R. Stoeger, "Epistemological and Ontological Issues Arising from Quantum Theory," in *Quantum Mechanics: Scientific Perspectives on Divine Action*, ed. Robert John Russell et al. (Vatican City: Vatican Observatory; Berkeley CA: CTNS, 2001) 81–98.

He proposes, first, that at the quantum level, we are dealing with aspects of reality that are independent of our measurements. The fact that, in our interactions with the quantum level, we find that this level of reality is resistant to our common assumptions is one indicator of this independence. Another indicator is the further fact that quantum theory successfully predicts and explains a whole range of other phenomena. The second part of Stoeger's proposal is that our knowledge of the underlying states is indirect—it is mediated through our measurements and through the theory. This means that a great deal of reality at the quantum level may completely escape our detection.

Stoeger discusses key features of quantum theory, including the following four: (1) *Uncertainty* points to the fact that we cannot simultaneously measure both the position and the momentum of a particle. (2) *Complementarity* means that, in different types of measurement, a given quantum system may sometimes manifest itself as a wave and at other times as a particle. (3) *The Problem of Measurement* springs from the fact that when a measurement is performed, only one of the possible outcomes at the quantum level is realized at the macro level—the wave function collapses to yield just one outcome. (4) *Decoherence* concerns the interaction between the shadowy, uncertain, but rich-in-potentialities quantum level and the macro level, where only some of the potentialities at the quantum level are realized. In this interaction, Stoeger writes, we find "objective chance, objective probability, and objective indefiniteness."[39]

Stoeger argues for the Copenhagen interpretation of quantum theory, which points to the objective character of chance, indefiniteness, and probability. In this interpretation it is only measurement, or interaction with the macroscopic world, that endows quantum systems with definite meaning and properties. He points out, however, that there is an increasing awareness that we must consider macroscopic objects themselves as quantum systems, so that all physical reality is understood as possessing a quantum character.

What does this say about our capacity to know reality as it is in itself? Stoeger believes: (1) there is a reality that exists independently of our knowing it, and that this reality is at least partially responsible for what we observe at both the quantum and classical levels. (2) We can say that we can have some limited knowledge of reality at the quantum level through this reality's manifestation of itself in our instruments of observation. We are therefore able to provisionally model what is knowable through the theoretical apparatus of quantum physics. And (3) we cannot know the objects or entities of the quantum world as they exist in themselves; they are "veiled" and partially hidden from view:

> We cannot say that the basic properties that characterize quantum reality as we observe it are actually possessed by the underlying quantum entities themselves. We can only say that there are properties of the underlying quantum entities—entities we represent by wavefunctions—that yield the properties we observe in our measurements when we interact with them using a macroscopic apparatus. Those observed properties are, in a sense, projections of the underlying quantum properties into the world of macroscopic experience through the interaction of quantum entities with macroscopic entities.[40]

39. Ibid. 91.
40. Ibid. 93.

At the quantum level, then, there must be properties that underlie and generate what we observe in quantum physics, such as uncertainty and complementarity. We can tentatively model this underlying reality, but this modeling means that something in the theory stands for, without necessarily describing, the underlying reality: "We are blocked . . . from asserting that such underlying properties actually describe the properties of the underlying quantum realities as they are."[41] Our knowledge of the underlying reality remains indirect and incomplete. We have good reason to believe, however, that what we observe in quantum physics is consistent with the underlying properties of the quantum world.

Stoeger does not believe that the wave function of quantum physics is an objective reality, but he holds that from a philosophical point of view it represents the hidden underlying objective reality. He contends that our knowledge of reality through quantum physics can be characterized as "weakly objective," in the sense that we know that this reality exists and manifests itself through our interactions with it, but we do not grasp reality as it is in itself.[42] The completeness attributed to the wave function applies only to our knowledge of it, to the properties we can observe; it does not represent everything about the underlying reality. What we do find is that quantum physics, along with aspects of reality studied in the other sciences, reveals a world that is "profoundly relational and interactive," where the systems and entities that make them up exist in interrelationship with one another, and where potentialities are realized only through these relationships.[43]

Stoeger sees these reflections on quantum physics as strongly reinforcing his earlier conclusions that, first, the laws of nature we formulate are imperfect and incomplete descriptions of the regularities, structures, relationships, and process of nature in itself, and second, that our laws of nature are descriptive rather than prescriptive. The quantum laws of nature do not directly describe what goes on "behind the veil" at the level of the underlying reality.[44] Stoeger brings his work to a conclusion with three comments on divine action in the light of this view of the laws of nature:

(1) God's universal creative action must take place, in part, "behind the veil," at the quantum level, in laws of nature, in regularities, processes and relationships, to which we have little access.
(2) There are similar, "veiled" realities at other levels of the natural world where we do not know the laws of nature as they actually function—even approximately. These include consciousness and the interpersonal, which are discussed in the second of the three essays. More to the point are the relationships between the transcendent Creator and human persons and communities, through experiences and manifestation of transcendence. It is here, he says, that God's special action seems to be focused. God's action appears in our

41. Ibid. 94.
42. Ibid.
43. Ibid. 95.
44. Ibid.

world as partially "veiled." Because it is partially veiled, the appearance of God's action can certainly reflect something of the divine reality, but God's action appears to us only on this side of the veil.

(3) Because it seems that God's special divine action is almost always effected in terms of God's personal relationship with human persons, it will involve top-down influences on the physical causal structure. It thus transcends the causes that we can perceive and model adequately in our physical sciences. This happens, of course, even in our inter-human relationships, but is far more pronounced if we think of the utterly transcendent and spiritual God in interrelationship with human persons.

What is the connection, the "causal joint," between God and creatures in special divine action as well as divine creative action? By way of answer, Stoeger returns to his earlier article on divine action: The causal nexus is the "active, richly differentiated, profoundly immanent (because it is transcendent) presence of God in created beings and their relationships."[45] God's action through secondary causes springs from the inclusion of creatures in God's own existence and relationships as Trinity: "The presence of God in each entity constitutes the direct, the immediate, relationship of that entity with God, and therefore is the channel of divine influence in secondary causes."[46] God acts, Stoeger proposes, not simply through the laws of nature as we know them, but through the laws of nature as they function in reality, including all the regularities, processes, and relationships of the natural world, many of which are hidden from our eyes or glimpsed only fleetingly.

Consequences for Theology: The Expansion of Our View of Secondary Causes

Stoeger was convinced that philosophy plays an indispensable mediating role in the relationship between science and theology. His three essays on the laws of nature explored here form a helpful philosophical mediation between science and the Christian theology of divine action and, more specifically, a fresh mediation between contemporary science and Aquinas's theology of a God who acts consistently through created causes.

A great deal of Christian theology involves divine action, including God's continuing creative act, God's providential care, divine revelation, the experience of God's grace, the incarnation, the resurrection, the promise of the transformation of human beings and, with them, the whole of creation, and miracles. The question, central for the discussion between science and theology, is how God's actions are to be understood. Are they to be understood in an interventionist sense as God overturning laws

45. Ibid. 97. See also Stoeger, "Describing God's Action in the World in Light of Scientific Knowledge of Reality," in *Chaos and Complexity* 253–54.

46. Stoeger, "Epistemological and Ontological Issues" 97–98.

of nature, or as putting them aside, in order to accomplish God's purposes? Or may we think of God acting in a way that fully respects the laws of nature, acting lovingly and effectively, but in a noninterventionist way? Here I focus on one important example of divine action, miracles, proposing that Stoeger's account of the laws of nature helps us understand miracles in a noninterventionist but genuinely theological way that builds on Aquinas.[47]

Aquinas holds that God is present to all things at their most interior level, enabling them to exist and act at every moment.[48] God's very nature is to exist, and God causes existence (*esse*) in all other beings. Nothing is more deeply interior to an entity than its existence. God is found in every dimension of creation: God "acts interiorly in all things," because "God is the cause of *esse*, which is innermost in all things"[49] All things exist only as created by God *ex nihilo* at every moment. They depend on God entirely for their existence and action at every moment. Following the language of Aristotle, but with his own profound theological convictions, Aquinas calls all the interacting causes found in the empirical world *secondary* causes. God, then, is the *primary* cause, the Creator always acting providentially in and through created causes. It is by God's power that every other power acts.[50]

God is not a cause like creaturely causes, but the uncreated ground of all creaturely causality. When God is described as a primary cause, the word "cause" is used only analogously to refer to the absolutely unique relationship between Creator and creatures, by which God confers existence on all things and enables them to be, to act, and to become. There is an infinite difference, then, between God's action and the actions of secondary causes in the world. Secondary causes include all the interacting causes found in empirical reality, absolutely all the patterns of relationship found in the natural world, everything studied by the sciences, and everything that could ever be studied by the sciences in the future.

According to Aquinas, God delights in creatures being truly causal in their own right: "Divine Providence works through intermediaries. For God governs the lower through the higher, not from any impotence on his part, but from the abundance of his goodness imparting to creatures the dignity of causing."[51] God so loves and respects the dignity of creatures that God wants them to be fully causal, respecting their integrity, dignity, and proper autonomy. Aquinas opposes those who would say that God acts alone and without intermediaries:

> But this is impossible, and first because it would deprive creation of its pattern of cause and effect, which in turn would imply lack of power in the creator, since an agent's power is the

47. I have developed a broader theology of divine action in *How God Acts: Creation, Redemption, and Special Divine Action* (Minneapolis: Fortress, 2010).
48. Thomas Aquinas, *Summa theologiae* (hereafter *ST*) 1, q. 8, a. 1. I am using the Blackfriars translation: Thomas Aquinas, *Summa theologiae* (London: Blackfriars in conjunction with Eyre & Spottiswoode, 1964–1980).
49. *ST* 1, q. 105, a. 6.
50. Thomas Aquinas, *Quaestiones disputatae de potentia Dei* q. 3, a. 7.
51. *ST* 1, q. 22, a. 3.

> source of its giving an effect a causative capability. It is impossible, secondly, because if the active powers that are observed in creatures accomplished nothing, there would be no point to their having received such powers. Indeed if all creatures are utterly devoid of any activity of their own, then they themselves would seem to have a pointless existence, since everything exists for the sake of its operation.[52]

God's love and respect for creation, therefore, is such that God wants creation to have its own pattern of cause and effect. God wants creaturely causes to have their own integrity and proper autonomy.

In the context of this deep respect for creaturely causes, how does Aquinas think about miracles? In a miracle, he says, the action of God replaces secondary causes. This means that miracles are "exceptions to the pattern in nature,"[53] which occur in a manner that "surpasses the capabilities of nature."[54] Aquinas sees a miracle as an event that occurs without a secondary cause:

> But if we take the order in things as it depends upon any of the secondary causes, then God can act apart from it; he is not subject to that order but rather it is subject to him, as issuing from him not out of necessity of nature, but the decision of his will. He could in fact have established another sort of pattern in the world; hence when he so wills, he can act apart from the given order, producing, for example, the effects of secondary causes without them or some effects that surpass the powers of these causes.[55]

In Aquinas's theology, as Brian Davies rightly points out, miracles surpass the natural order but do not do violence to it.[56] If God brings about something miraculous in the natural order, this is no more a violation of the natural order than the fact that the order exists in the first place.[57]

While this is true, it is precisely at this point that Stoeger's insights into the laws of nature enable us to go further than Aquinas. In my view, Aquinas's thought is indispensable in the dialogue between science and theology, with his concept of primary and secondary causality and his view of God's profound respect for secondary causes. But what if God works through secondary causes even in the case of many of the events in the Gospels and in our lives that we rightly see as miracles, as marvelous gifts of God?

Stoeger's distinction between the laws of nature as we know them and model them and the laws of nature understood as the regularities, potentialities, and processes of the natural world itself greatly expands our understanding of the ways God works through the natural world. Stoeger's distinction enables us to see more clearly that, in thinking about God's action, we are not limited to the two alternatives: divine action that is either in conformity with our laws of nature or not. It is not simply a choice

52. *ST* 1, q. 105, a. 6.
53. *ST* 1, q. 105, a. 7 ad 1.
54. *ST* 1, q. 105, a. 7 ad 2.
55. *ST* 1, q. 105, a. 6.
56. Brian Davies, *The Thought of Thomas Aquinas* (Oxford, Clarendon, 1992) 173.
57. Ibid.

between God's working through our laws of nature or God's overturning or bypassing them. God might be working through all the unknown or partly known possibilities of the natural world that far surpass what we already know and model.

Stoeger's enormous expansion of the laws of nature applies with equal force to what Aquinas calls secondary causes, which are simply all the interactions we perceive in the empirical world. When we extend our understanding of these interactions to include those that contemporary science glimpses, such as those operating in the mind–brain relationship, and those at work at the quantum level, those that we simply do not know at all, then the range of secondary causes is mightily extended. Here, too, in and through the natural world, including the many aspects of the natural world not yet mapped by our scientific laws, God may work marvels for God's people.

What I am proposing here, then, does not mean any kind of rejection of the theology of miracles. As John Meier has shown at length, miracles cannot be dismissed from the Gospel narratives without completely distorting their accounts of Jesus. Miracles are intrinsic to his life and work.[58] And the experience of miracles has been part of Christian life through all the ages since. The position taken here is that miracles do occur as marvelous acts of God in our history. The question is whether miracles are necessarily acts of God that occur without secondary causes. Stoeger's account of the laws of nature creates room for God to be seen as, at least possibly, acting in miracles through secondary causes, through aspects of nature that we have not mapped with our scientific theories.

Such an interpretation, then, would support Karl Rahner's contention that there is no reason why the laws of nature would need to be abolished or suspended if God's self-communication were to take place through laws that are, because of God's creative act, the very precondition for this divine self-giving.[59] This interpretation of Stoeger would also support the position of Gerhard Lohfink, who writes of the existence of Jesus as altogether in harmony with the will of God, so that in his miracles he "called upon the powers of this world, extending into a profound depth that is impenetrable for us today."[60] He goes on to say that "no one can define where the limits of 'nature' in this sphere lie, unless one would lay claim to having an absolutely complete and comprehensive knowledge of all the powers at work in nature. Who would dare to make such an assertion?"[61]

Building on Stoeger's insights I have sought to show that the vehicle for God's action in creation, grace, incarnation, and miracles is not simply the world our sciences model with our discovered laws of nature. Rather, the vehicle of God's self-manifestations and actions, even in the case of miracles, is the wonderful, far more mysterious

58. John P. Meier, *A Marginal Jew: Rethinking the Historical Jesus*, vol. 2, *Mentor, Message, and Miracle*s (New York: Doubleday, 1994) 509–1038.
59. Karl Rahner, *Foundations of Christian Faith* (New York Seabury, 1978) 261.
60. Gerhard Lohfink, *Jesus of Nazareth: What He Wanted, Who He Was* (Collegeville, MN: Liturgical, 2012) 142.
61. Ibid. 142–43.

world of nature itself, including those aspects of the natural world that still escape our scientific modeling.

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